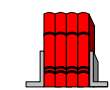


Chapter 7: Additions and Alterations

7.0 SUMMARY

This chapter discusses requirements and options for demonstrating compliance with the requirements of the *Energy Efficiency Standards* (standards) for residential additions and alterations. Part 7.1 introduces the topic and lists compliance options for residential additions. Part 7.2 covers energy analysis of the addition alone, including both prescriptive and performance options. Part 7.2 also explains how to demonstrate water heating energy compliance when analyzing an addition alone. Part 7.3 describes the Existing-Plus-Addition method of compliance for use with approved computer performance methods. It includes discussion of assumptions permitted when modeling an existing building. Part 7.4 provides information on space-conditioning equipment for additions, including restrictions on installing electric resistance space heating. Part 7.5 covers alterations and meeting energy compliance requirements. Part 7.6 discusses compliance requirements for building repairs.

7.1 INTRODUCTION



Energy Code

Addition/Alteration/Repair
(Section 101(b))

ADDITION is any change to a building that increases conditioned floor area and conditioned volume. See also, NEWLY CONDITIONED SPACE.

ALTERATION is any change to a building's water heating system, space conditioning system, lighting system, or envelope that is not an addition.

NEWLY CONDITIONED SPACE is any space being converted from unconditioned to directly conditioned or indirectly conditioned space . . .

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Applicable sections of the California Code of Regulations, Title 24, Part 6: Sections 101, 110 through 118, 150, 151 and 152.

Newly conditioned space must comply with the requirements for an addition. See . . . Section 152 for residential occupancies.

REPAIR is the reconstruction or renewal of any part of an existing building for the purpose of its maintenance. Note: Repairs to low-rise residential buildings are not within the scope of these standards.



Introduction

Additions, Alterations, Repairs

Residential additions and alterations are common types of new construction. This chapter covers all compliance requirements and compliance alternatives unique to additions and alterations.

ADDITIONS

Additions are any changes to an existing building that increase the conditioned floor area *and* volume. Converting a garage or unheated basement into a conditioned living space, enclosing and conditioning a patio, or building onto a home are all examples of an addition. Compliance is based on the climate zone (see Appendix C) in which the building is located.

Other information on the subjects of the prescriptive packages and the computer performance method is contained in Chapters 3 and 4.

Compliance Options for Additions

Any one of several options may be used in demonstrating compliance for an addition:

- Show that the addition alone meets the applicable prescriptive requirements (Figure 7-1) or the performance method energy budget.
- Show that the remodeled building including the addition ("existing-plus-addition") uses the same or less energy than the unimproved building and a separate addition that meets the performance method energy budget (Figure 7-2).
- Show that the entire building meets the prescriptive requirements or the performance method energy budget for the building as a whole (Section 152(d)).

Characteristics of Prescriptive, Addition Alone

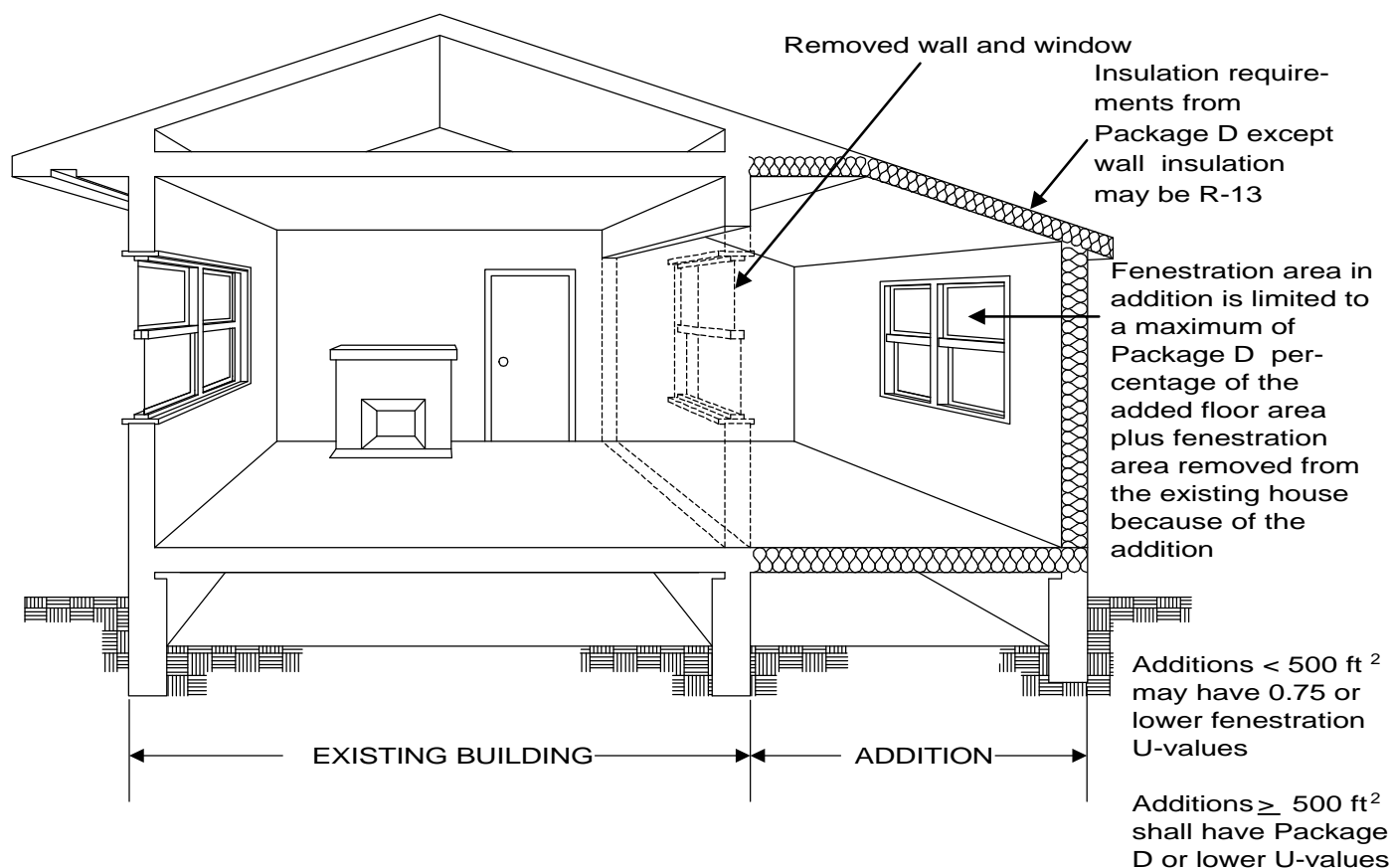
- Simplest to document.
- Very small additions have less stringent requirements.
- Limited to Package D only.
- New space-conditioning systems require setback thermostat (exceptions do not apply).
- Limited to percentage of glass allowed by Package D (with credit for glazing removed from the existing building).
- Any dual glazed skylight or dual-glazed greenhouse window can be assumed to meet the U-value requirement.

Characteristics of Performance, Addition Alone

- Some flexibility
- Existing structures with R-11 in the framed walls do not have to meet the R-13 mandatory requirement.
- If one of the non-central space-conditioning systems is installed, no setback is required as long as a "no setback" condition is modeled .
- Allows tradeoffs in efficiency measures (e.g., R-19 ceilings with lower glass U-value).
- Can exceed prescriptive limitations on glass.
- Any dual-glazed skylight or dual-glazed greenhouse window can be assumed to meet the U-value requirement.

Characteristics of Performance, Existing-Plus-Addition

- Same characteristics as noted above for performance compliance of addition alone.
- Most flexibility.
- Allows efficiency improvements to the existing structure to compensate for inefficiencies in the addition.
- Allows credit for energy efficiency improvements made in the past.



**Figure 7-1 Compliance Option for Addition:
Package D For Addition Alone (floor area less than 1000 ft²)**

ALTERATIONS

Within the context of the standards, alterations are changes to a building's envelope, space-conditioning system, water-heating system or lighting system which are not additions. An alteration does not increase both conditioned volume and floor area. Examples include:

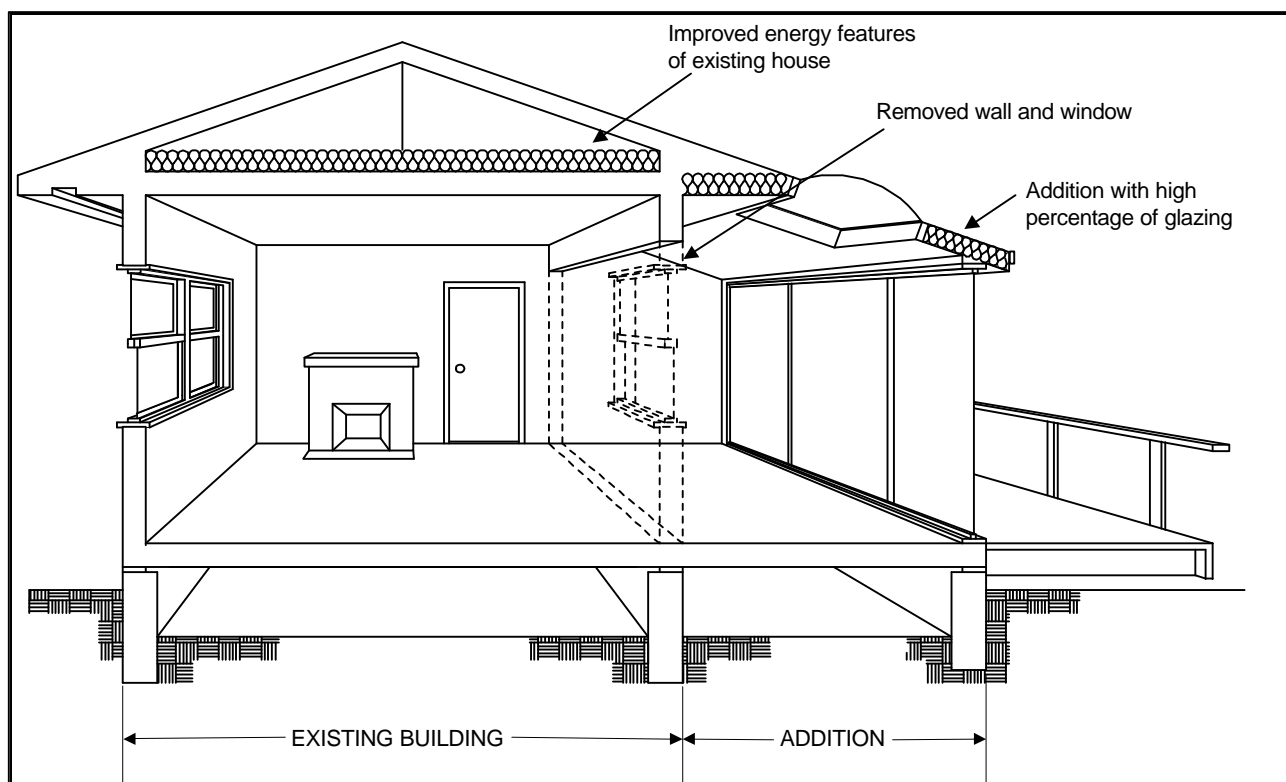
- Adding a new skylight (or window) to an existing building. If the skylight has a light well that cuts through an existing attic, the alteration adds conditioned volume but is not an addition because it does not add conditioned floor area.
- Adding a new greenhouse window to an existing building. This is an alteration rather than an addition because it adds conditioned volume to the building but not conditioned floor area.

- Adding a loft within the existing conditioned volume of a residence. This is an alteration rather than an addition because it adds conditioned floor area but not conditioned volume.

Compliance Options for Alterations

Prescriptive compliance requires meeting mandatory measures on new systems or components being altered. New windows being added must meet a maximum U-value of 0.75 (except dual-glazed skylights and dual-glazed greenhouse windows). Changing fuel types on equipment replacements is restricted.

Performance compliance requires meeting mandatory measures on new systems or components being altered. There is no limit on the U-value of windows, and there is no restriction on changing fuel types, as long as the energy budget can be met.



**Figure 7-2: Compliance Option for Addition:
Performance Analysis of the Existing House Plus Addition**

REPAIRS

Repairs are not included in the definition of an alteration. Repairs are discussed in Section 7.6.



Examples

Additions, Alterations, Repairs

The Energy Efficiency Standards do not specify whether buildings damaged by natural disasters can be reconstructed to their original energy performance specifications. What requirements apply under these circumstances?

Buildings destroyed or damaged by natural disasters must comply with the energy code requirements in effect when the builder or owner applies for a permit to rebuild. The requirements that apply will depend on whether the scope of work is an addition, alteration or new building.

How can I determine if the scope of work is an addition, alteration or new building? And what requirements apply?

Section 100 of the standards indicates that the standards apply to buildings “for which an application for a building permit or renewal of an existing permit is filed (or required by law to be filed).” It comes down to whether the change is an “addition” or an “alteration.”

Changes that require a building permit for an increase in conditioned floor area and conditioned volume are “additions.” An addition meets the requirements found in Section 152(a).

Changes that require a building permit but do not add conditioned floor area and conditioned volume are “alterations.” An alteration is any change to an existing building’s water-heating, space-conditioning or lighting system, or to the envelope, that is not an addition. Alterations must meet any mandatory requirements that apply to the specific component being changed (Section 152(b)).

Rebuilding after a natural disaster (if a permit is required) will likely be either an alteration (Section 152(b)) or a new building (Section 100(d)). Requirements for new buildings apply if the local building official determines that the reconstruction is so extensive it is a new building.

Repairs and maintenance work *that do not require a building permit* are not covered by the standards.

Is a detached addition to an existing residence (with no breezeway) an addition or a new building?

This depends on the type of permit issued by the local building department. If the permit is for an addition, you can use compliance approaches approved for additions. If the permit type is for a new residential building, then you must use compliance approaches appropriate for new buildings.

Example 7-1: Alteration that increases conditioned floor area, but not volume

A 200 square foot sleeping loft is added to an existing building. The loft is being installed within an existing two-story high space in the conditioned envelope. No fenestration is added.

Since no conditioned volume is being added to the building, this is an alteration rather than an addition. As such, it only needs to comply with all applicable mandatory measures.

When modeling/accounting for greenhouse windows, which compliance approach allows the use of the “assumed” U-value of 0.75 for skylights and greenhouse windows? Do I use the entire glass area?

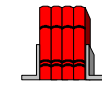
In *additions* and *alterations* only, you can use a 0.75 U-value for dual-glazed greenhouse windows or skylights with any compliance method. In new construction, the actual U-value of fenestration products is used for compliance documentation/calculations. For greenhouse windows, the area of glass is the rough opening.

If I remove a window from the existing house while doing an addition, can I re-use this window in the addition, or does it need to meet a certain U-value?

You can use this existing window in the addition; however, you must use a compliance approach that allows you to account for the actual U-value of this window, which may eliminate prescriptive compliance (see default values in Table 7-3). Window certification and labeling requirements (Section 116(a)) do not apply to these used windows.

7.2 COMPLIANCE ANALYSIS OF ADDITION ALONE

Any addition—that is, the sum of all new conditioned spaces and associated new exterior walls, ceilings and floors within the building—may be shown to meet the energy budget as a separate entity. This procedure does not involve the existing structure. The analysis may be performed using either a special prescriptive package according to the size of the addition or with an approved computer performance method.



Energy Code

Prescriptive (Section 152(a), (d))

Additions to existing residential buildings shall meet the requirements of Sections 111 through 118, Section 150, and either Section 152(a)1. or Section 152(a)2.

...

EXCEPTION No. 2 to Section 152(a): Any dual-glazed greenhouse window and dual-glazed skylight installed in an addition complies with Section 151(f)2.A.

...

EXCEPTION No. 4 to Section 152(a): When heating and/or cooling will be extended to an addition from the existing system(s), the existing equipment need not comply with Title 24, Part 6. The heating system capacity must be adequate to meet the minimum requirements of UBC Section 310.11.

1. **Prescriptive Approach.** Additions to existing buildings shall meet the following additional requirements:

- A. Additions up to 100 square feet shall not exceed 50 square feet of glazing and the glazing U-value shall not exceed 0.75; or
- B. Additions less than 1000 square feet shall meet all the requirements of Package D [Section 151(f) and Tables No. 1-Z1 through 1-Z16], except that the addition's total glazing area limit is the maximum allowed in Package D plus the glazing area that was removed by the addition and the wall insulation value need not exceed R-13.

EXCEPTION to Section 152 (a) 1.B.: If an addition is less than 500 square feet, glazing may have a U-value not to exceed 0.75 in lieu of any lower U-value required by the Package.

- C. Additions of 1000 square feet or greater shall meet all the requirements of Package D [Section 151(f) and Tables No. 1-Z1 through 1-Z16].



Compliance/
Plan Check

Prescriptive Addition Alone

Using prescriptive compliance to show compliance for an addition alone is the simplest (although least flexible) approach. This section discusses the application of prescriptive compliance to an addition. For more information on prescriptive compliance see Chapter 3, Part 3.3.

Documentation

Compliance of a prescriptive addition alone is documented on a:

1. Certificate of Compliance (CF-1R) (see Chapter 1), and
2. Mandatory Measures Checklist (MF-1R) (see Chapter 2).

Other compliance forms may be required to document, for example, water heating compliance.

Mandatory Measures

All mandatory measures apply to any new construction (see Chapter 2). For example, if a new space-heating system is being installed in the addition, the equipment must be certified, sizing calculations are required, ducted systems must meet insulation and installation requirements, and a setback thermostat is required (the exceptions apply only to performance compliance, not prescriptive compliance).

If a garage is being converted into conditioned space, the walls must meet current mandatory requirements. If the walls were previously insulated with R-11 they must be upgraded to R-13, or you can use a performance compliance approach (see Computer Method in this Part 7.2).

Envelope Measures

Envelope measures vary with the size of the addition (see Table 7-1).

Additions up to 100 square feet must meet mandatory insulation levels (R-13 wood frame walls, R-19 ceilings), and are limited to 50 square feet of glass with a maximum U-value of 0.75. This approach does not allow credit for glass removed because of the addition; however, compliance with the requirements for additions of less than 500 square feet is allowed, in which case credit for glazing removed is allowed.

Additions of less than 500 square feet meet the requirements of package D (Chapter 3) for the applicable climate zone (Appendix C) with the following exceptions: walls meet only the mandatory insulation level of R-13 in a wood frame; glass is limited to a maximum U-value of 0.75; glass area is limited to the percentage allowed by the package, plus any glass removed because of the addition.

Additions of *less than 1,000 square feet* meet the requirements of package D for the applicable climate zone with the following exceptions: walls meet only the mandatory insulation level of R-13 in a wood frame; glass area is limited to the percentage allowed by the package plus any glass removed because of the addition.

Additions of *1,000 square feet or more* meet all of the requirements of package D.

Dual-Glazed Skylights and Dual-Glazed Greenhouse Windows

Dual-glazed skylights or dual-glazed greenhouse windows are treated as though they have the U-value required for prescriptive compliance.

Dual-glazed skylights and dual-glazed greenhouse windows should be included in compliance calculations as a fenestration product with a U-value equivalent to the Package D requirement for the appropriate climate zone (or 0.75 for additions of less than 500 square feet).

**Table 7-1: Prescriptive Compliance of Additions -
Summary of Section 152(a)1 Requirements of the *Standards***

COMPONENT	< 100 ft ²⁽¹⁾	< 500 ft ²	≥ 500 but <1000 ft ²	≥1,000 ft ²
Insulation				
Ceiling	R-19	Package ²	Package	Package
Wall ³	R-13	R-13	R-13	Package
Floor	Mandatory ⁵	Package	Package	Package
Fenestration				
Max. U-Value ⁴	0.75	0.75	Package	Package
% of CFA	≤ 50 ft ²	Pkg. + Removed ⁵	Pkg. + Removed ⁵	Package
Shading	N/A	Package	Package	Package
Space Heating ⁷ & Cooling	Mandatory ⁶ (No electric)	Package (No electric)	Package (No electric)	Package (No electric)
Water Heating ⁶				
Replacement	N/A	N/A	N/A	N/A
Increase	See Table 7-2	See Table 7-2	See Table 7-2	See Table 7-2

1. This approach does not allow credit for glass removed. Compliance with the requirements for additions of less than 500 square feet is allowed, in which case credit for glazing removed is allowed.
2. Meet the component prescriptive requirement for Package D (see Chapter 3) and all mandatory requirements.
3. "Heavy Mass" and "Light Mass" walls may meet the Package D requirements for mass wall insulation instead of R-13 (see Chapter 3).
4. For addition and alteration compliance only, dual-glazed greenhouse windows and dual-glazed skylights are assumed to meet this requirement.
5. The Package D fenestration area plus the area of any glazing removed because of the addition.
6. All applicable mandatory measures must be met (see Chapter 2).
7. No electric resistance space heating may be installed.

Space-Conditioning Measures

If the existing heating and cooling system will serve the addition, there are no requirements that apply to the existing equipment. However, the enforcement agency may ask for verification that the capacity of the heating equipment is adequate for meeting the extra load created by the addition, in which case sizing/load calculations must be prepared.

NOTE:

Package D does not allow electric resistance space heating. When using a prescriptive approach for the addition alone, electric resistance or electric radiant space heating meets the heating system requirement only as an existing system already installed in an existing building.

If a new space-conditioning system is installed to serve the addition alone, or the addition and existing building, all mandatory measures shall apply (load calculations, certified equipment, duct insulation and installation, setback thermostat). No electric resistance space heating is allowed with prescriptive compliance. Gas or heat pump heating are permitted. If the equipment meets appliance certification requirements, as explained in Chapter 2, the efficiency is acceptable for prescriptive compliance.

Water Heating Measures

If an existing water heater is being replaced (including an increase in volume) only mandatory measures (certification, pipe insulation, tank insulation) apply (see Chapter 2, Part 2.4).

When a water heater is being added, increasing the number of water heaters in the building, see water heating below in this Part 7.2.



Energy Code

Performance Addition Alone
(Section 152(a), (a)2)

Additions to existing residential buildings shall meet the requirements of Sections 111 through

118, Section 150, and either Section 152(a)1. or Section 152(a)2.

EXCEPTION No. 1 to Section 152(a): Existing structures with R-11 framed walls showing compliance with Section 152(a)2. (Performance Approach) are exempt from Section 150(c).

EXCEPTION No. 2 to Section 152(a): Any dual-glazed greenhouse window and dual-glazed skylight installed in an addition complies with Section 151(f)2.A.

...

EXCEPTION No. 4 to Section 152(a): When heating and/or cooling will be extended to an addition from the existing system(s), the existing equipment need not comply with Title 24, Part 6. The heating system capacity must be adequate to meet the minimum requirements of UBC Section 310.11.

...

2. **Performance Approach.** Performance calculations shall meet the requirements of Section 151(a)-(e), pursuant to either A or B, below.

A. *The addition complies if the addition alone meets the combined water heating and space conditioning energy budgets.*



Compliance/
Plan Check

Performance
Addition Alone

Any addition may be analyzed alone using a computer method. Compliance for the addition is the same as showing compliance for a new building (see also Chapter 4). This part discusses performance compliance requirements unique to an addition. Refer also to the program compliance supplement provided by the vendor of the program you're using for further information on modeling additions alone.

Analyzing additions alone works well for relatively large additions with moderate window and skylight area. If an addition alone does not comply with the standards, improvements to the existing building may be necessary in order for the addition to comply (see Part 7.3).

Documentation

Compliance of an addition alone using a performance approach is documented on a:

1. Certificate of Compliance (CF-1R) (see Chapter 1),
2. C-2R (computer, see Chapter 5) and
3. Mandatory Measures Checklist (MF-1R) (see Chapter 2).

Mandatory Measures

All mandatory measures apply to any new construction. For example, if a new space-heating system is being installed in the addition, the equipment must be certified, sizing calculations are required, ducted systems must meet insulation and installation requirements, and a setback thermostat is required unless (1) the system type is shown in the Exception to Section 150(i) and (2) a non-setback thermostat is modeled. All mandatory measures are explained in Chapter 2.

If a garage is being converted into conditioned space, the walls must meet current mandatory requirements. If the walls were previously insulated with R-11, compliance must be achieved with the existing R-11 insulation.

Envelope Measures

Envelope compliance is based on prescriptive Package D with credit for more energy efficient measures and penalty for less efficient measures. The only limitation is minimum mandatory measures: ceilings must have a weighted average equivalent to R-19 installed between wood framing, and framed walls must have a weighted average equivalent to R-13 installed between wood framing (except as noted above for existing walls insulated to R-11).

Dual-Glazed Skylights or Dual-Glazed Greenhouse Windows

Dual-glazed skylights or dual-glazed greenhouse windows are treated as though they have the U-value required for compliance with package D.

Any dual-glazed skylight or dual-glazed greenhouse window area should be included in compliance calculations as a fenestration product with a U-value equivalent to the Package D maximum U-value requirement (see Chapter 3, Part 3.4).

Space-Conditioning Measures

If the existing heating and cooling system will serve the addition, there are no requirements that apply to the existing equipment, and the effect is neutral. The computer model should show equipment with an efficiency equal to 78 percent AFUE central furnace and 10 SEER cooling, with R-4.2 ducts in the attic, regardless of the actual conditions.

The enforcement agency may ask for verification that the capacity of the heating equipment is adequate for meeting the extra load created by the addition, in which case sizing/load calculations must be prepared.

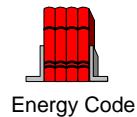
If a new space-conditioning system is installed to serve the addition alone, or the addition and existing building, all mandatory measures shall apply (load calculations, certified equipment, setback thermostat, duct insulation and installation). If a new, high efficiency HVAC distribution system is used to serve the addition or the addition and the existing building, that system may be modeled to receive energy credit subject to diagnostic testing and verification of proper installation by a HERS rater (see Chapter 4).

If a non-central space-conditioning system of one of the following types is installed:

- Gravity-gas wall heaters
- Gravity floor heaters
- Gravity room heaters
- Non-central electric heaters
- Room air conditioners
- Room air conditioner heat pumps

then a setback thermostat is not required if a “no setback” condition is modeled if a setback thermostat is not installed.

New space-conditioning equipment is modeled using its actual characteristics. If the new equipment serves the existing building as well as the addition, the full capacity can be modeled.



Water Heating, Addition Alone
(Section 152(a))

EXCEPTION No. 3 to Section 152(a): If the addition will increase the total number of water heaters in the building, one of the following types of water heaters may be installed to comply with Section 152(a)1. or Section 152(a)2.A, and Section 152 (c):

- (1) A gas storage non-recirculating water heating system that does not exceed 50 gallons capacity; or
- (2) If no natural gas is connected to the building, an electric storage water heater that does not exceed 50 gallons capacity, has an energy factor not less than 0.90; or
- (3) A water heating system determined by the Executive Director to use no more energy than the one specified in (1) above; or if no natural gas is connected to the building, a water heating system determined by the Executive Director to use no more energy than the one specified in (2) above.

For prescriptive compliance with Section 152(a)1., the water heating systems requirement in Section 151(f)8. shall not apply. For performance compliance for the addition alone, only the space conditioning budgets of Section 151(b)2. shall be used; the water heating budgets of Section 151(b)1. shall not apply.

The performance approach for the existing building and the addition in Section 152(a)2.B may be used to show compliance, regardless of the type of water heater installed.



Water Heating, Addition Alone

Compliance/
Plan Check

When a new water heater is added as part of an addition, and it increases the total number of water heaters in the entire building, the standards allow addition alone compliance only when:

1. Installing a gas water heater, 50 gallons or less, non-recirculating; or one that uses equal or less energy (see Table 7.2); or
2. If there is no natural gas connected to the building, installing a 50-gallon or less electric water heater with a 0.90 Energy Factor; or one that uses equal or less energy (see Table 7-2), and
3. The water-heater system is not included in the compliance calculations.

Special Documentation

When there is an increase in water heaters meeting the conditions described in 1-3 above or from Table 7-2, special water heating documentation requirements apply. The systems must be energy neutral in the addition alone compliance. This is achieved by the following:

<i>Prescriptive Compliance</i>	No Water Heating Calculations required
<i>Computer Compliance</i>	Model "Standard: water heater - 50 gallon gas, nonrecirculating, 0.53 energy factor, standard distribution

The C-2R must reflect equivalent water heating energy use for the "standard" and "proposed" building (compliance margin 0).

Actual system features should be noted or written on the CF-1R, under Water-Heating Systems or Special Features.

Other Options

To take credit for a more efficient added water heater, or for a water-heating system with features other than those outlined in Table 7-2, you must use an existing-plus-addition compliance approach for an increase in the number of water heaters in the entire building.



Addition Alone Construction

Make note of any construction requirements on the plans and Certificate of Compliance (CF-1R).

For detailed construction guidelines and documentation requirements for the builder, see Chapters 2 and 3.

As applicable, an Installation Certificate (CF-6R) for equipment and fenestration products, must be completed and signed, as well as an Insulation Certificate (IC-1). Construction must be equal or better to information on the Certificate of Compliance (CF-1R).



Addition Alone Inspection

The inspector should make note of construction indicated on the CF-1R.

Before making a visual inspection, check the Certificate of Compliance (CF-1R) and compare it to the Installation Certificate (CF-6R) for equipment and fenestration products, and the Insulation Certificate (IC-1) if there are any building envelope alterations.

For more detailed inspection guidelines, see Chapters 2 and 3.

7.3 Compliance Analysis Using the Existing-Plus-Addition Method



Energy Code

Performance, Existing-Plus-Addition Approach. (Section 152(a))

Additions to existing residential buildings shall meet the requirements of Sections 111 through 118, Section 150, and either Section 152(a)1. or Section 152(a)2.

EXCEPTION No. 1 to Section 152(a): Existing structures with R-11 framed walls showing compliance with Section 152(a)2. (Performance Approach) are exempt from Section 150(c).

EXCEPTION No. 2 to Section 152(a): Any dual-glazed greenhouse window and dual-glazed skylight installed in an addition complies with Section 151(f)2.A.

...

EXCEPTION No. 4 to Section 152(a): When heating and/or cooling will be extended to an addition from the existing system(s), the existing equipment need not comply with Title 24, Part 6. The heating system capacity must be adequate to meet the minimum requirements of UBC Section 310.11.

...

Table 7-2: Additions Involving an Increase in the Number of Water Heaters

The following water heating systems have been determined to be equivalent to Section 152(a), Exception No. 3. See special documentation requirements above.

A water heater with the following characteristics may be installed in an addition to a building with a *natural gas connection*, without credit/penalty in compliance calculations:

Fuel/Type	Capacity	Efficiency	Distribution
Gas/Storage	50 gallon	≥ 0.53 EF	Standard
Gas/Storage	75 gallon	≥ 0.52 EF	PI
Gas/Storage	75 gallon	≥ 0.52 EF	POU
Gas/Storage	75 gallon	≥ 0.52 EF	HWR
Gas/Storage	75 gallon	≥ 0.52 EF	WSB
Gas/Instantaneous	N/A	≥ 0.62 EF	Standard

A water heater with the following characteristics may be installed in an addition to a building with *no natural gas connection*, without credit/penalty in compliance calculations:

Fuel/Type	Capacity	Efficiency	Distribution
Electric/Storage	50 gallon	> 0.90 EF	Standard
Electric/Storage	50 gallon	> 0.86 EF	POU
Electric/Storage	50 gallon	> 0.86 EF	HWR
Electric/Storage	50 gallon	> 0.86 EF	WSB
Electric/Storage	50 gallon	> 0.86 EF	PI
Electric/Storage	50 gallon	> 0.86 EF	R/D & HWR
Electric/Storage	75 gallon	> 0.95 EF	Standard
Electric/Instantaneous	N/A	$> 98\%$ RE	Standard

EF = Energy Factor

RE = Recovery Efficiency

Distribution Systems (see Chapter 6, Parts 6.1 and 6.6, for complete information on distribution system installation criteria):

Standard: No pumps, R-4 insulation on first 5 feet of hot and cold water pipes
POU: Point of Use
PI: Pipe Insulation
HWR: Hot Water Recovery System
WSB: Wood Stove Boiler
R/D & HWR: Recirculation system with a Demand control, combined with Hot Water Recovery

...

2. **Performance Approach.** *Performance calculations shall meet the requirements of Section 151(a)-(e), pursuant to either A or B, below.*

...

- B. *The addition complies if the energy efficiency of the existing building is improved such that the source energy consumption of the improved existing building and the addition is equal to or less than that of the unimproved existing building plus an addition that complies with the applicable energy budget.*



Compliance/
Plan Check

Existing-Plus-Addition

The most flexible method for showing compliance for an addition is to consider the entire existing building along with the addition. By comparing building energy consumption before and after the remodel, credit may be taken for improvements to the energy efficiency features in the existing building. Compliance is shown using an approved computer compliance program. This part discusses performance compliance requirements unique to an addition. Refer also to the program compliance supplement provided by the vendor of the program you're using for further information on modeling additions.

Documentation

Compliance of an existing-plus-addition is documented on a Certificate of Compliance (CF-1R) (see Chapter 1) two C-2Rs (one for the existing and one for the existing-plus-addition), and a Mandatory Measures Checklist (MF-1R) (see Chapter 2).

Mandatory Measures

All mandatory measures apply to any new construction. For example, if a new space-heating system is being installed in the addition, the equipment must be certified, sizing calculations are required, ducted systems must meet insulation and installation requirements, and a setback thermostat is required unless (1) the system type is shown in the Exception to Section 150(i) and (2) a non-setback thermostat is modeled. All mandatory measures are explained in Chapter 2.

If a garage is being converted into conditioned space, the walls must meet current mandatory requirements. If the walls were previously insulated with R-11, compliance must be achieved with the existing R-11 insulation.

Envelope Measures

Envelope compliance for the addition is based on prescriptive Package D with credit for more energy efficient measures and penalty for less efficient measures. The only limitation is minimum mandatory measures for new construction: ceilings must have a weighted average equivalent to R-19 installed between wood framing, and framed walls must have a weighted average equivalent to R-13 installed between wood framing (except as noted above for existing walls insulated to R-11).

Dual-Glazed Skylights or Dual-Glazed Greenhouse Windows

Dual-glazed skylights or dual-glazed greenhouse windows are treated as though they have the U-value required for compliance with package D.

Any new dual-glazed skylight or dual-glazed greenhouse window area should be included in compliance calculations as a fenestration product with a U-value equivalent to the Package D maximum U-value requirement for the appropriate climate zone (see Chapter 3, Part 3.4).

Space Conditioning Measures

If the existing heating and existing cooling system will serve the addition, there are no requirements that apply to the existing equipment, and the effect is neutral. The computer model should show equipment with an efficiency equal to 78 percent AFUE central furnace and 10 SEER cooling, with R-4.2 ducts in the attic, regardless of the actual conditions.

The enforcement agency may ask for verification that the capacity of the heating equipment is adequate for meeting the extra load created by the addition, in which case sizing/load calculations must be prepared.

If a new space-conditioning system is installed to serve the addition alone, or the addition and existing building, all mandatory measures shall apply (load calculations, certified equipment, duct insulation and installation, setback thermostat). If a non-central space-conditioning system of one of the following types is installed:

- Gravity-gas wall heaters
- Gravity floor heaters
- Gravity room heaters
- Non-central electric heaters
- Room air conditioners
- Room air conditioner heat pumps

then a setback thermostat is not required, but a “no setback” condition must be modeled.

New space-conditioning equipment is modeled using its actual characteristics. If the new equipment serves the addition alone, it is necessary to determine a weighted average efficiency based on the floor area served by each system.

If a new, high efficiency HVAC distribution system is used to serve the addition or the addition and the existing building, that system may be modeled to receive energy credit subject to diagnostic testing and verification of proper installation by a HERS rater (see Chapter 4).

EXISTING BUILDING ASSUMPTIONS

When performing an existing-plus-addition analysis, determine existing building conditions

according to Table 7-3 which lists default assumptions for existing buildings. These default assumptions should be used unless actual field conditions can be documented.

NOTE:

The same values should be modeled for the existing house in both the existing and the existing-plus-addition analyses unless specific improvements, including those previously installed, can be documented. To take credit for past improvements, documentation verifying the improvement must be presented to the building department.

Existing Building Constructed Completely Before 1978

If an existing building was constructed before 1978, and the building has not had any additions constructed since 1978, assumptions about the existing insulation levels, fenestration U-values and solar heat gain coefficients, space-conditioning systems and water-heating systems may be made as summarized in Table 7-3 in lieu of field inspection or as-built drawings.

Construction that is known to be more energy efficient than the listed default values must be assumed to be original construction in the existing house (assumed in both “existing” and “existing-plus-addition” documentation), unless a legitimate written or visual record of the improvement(s) can be provided by the owner. Legitimacy is at the discretion of the local building official. Once an improvement is shown not to be the original construction, assume the originally constructed value in this “existing” building documentation, and the improved construction in the “existing-plus-addition” documentation.

Existing Buildings Constructed from 1978 to the Present

All new residential construction and additions built in California from 1978 to the present were required to comply with the standards. Therefore, some minimum values must be assumed for existing buildings constructed during this period.

Table 7-3: Default Assumptions for Existing Buildings¹

Table 7-3: Default Assumptions for Existing Buildings ¹				
	Default Assumption for Year Built			
Feature	Before 1978	1978 to 1983	1984 to 1991	1992 to 1998
INSULATION (U-VALUE)				
Roof	0.076	0.047	0.047	0.047
Wall	0.386	0.096	0.096	0.088
Raised Floor - Crawlspace	0.097	0.097	0.097	0.037
Raised Floor - No Crawlspace	0.239	0.239	0.239	0.097
Slab Edge (F2)	0.72	0.72	0.72	0.72
Ducts	R-2.1	R-2.1	R-2.1	R-4.2
LEAKAGE				
Building (SLA)	4.9	4.9	4.9	4.9
Ducts	28%	28%	28%	28%
FENESTRATION				
U-value	Use Table 1-D, Title 24, Part 6, Section 116 for all vintages			
SHGC	Use Table 1-E, Title 24, Part 6, Section 116 for all vintages			
Shading Device	Use current value for installed device			
SPACE HEATING EFFICIENCY ²				
Gas Furnace (Central), AFUE	0.75	0.78	0.78	0.78
Heat Pump, HSPF	5.6	5.6	6.6	6.6
Electric Resistance, HSPF	3.41	3.41	3.41	3.41
SPACE COOLING EFFICIENCY				
All Types, SEER ²	8.0	8.0	8.9	9.7
WATER HEATING				
Energy Factor	0.53	0.53	0.53	0.53
Rated Input, MBH ²	28.0	28.0	28.0	28.0
1. Based on historic data and utility (Residential Conservation Service) conservation programs.				
2. AFUE = Annual Fuel Utilization Efficiency				
HSPF = Heating Seasonal Performance Factor				
SEER = Seasonal Energy Efficiency Ratio				
MBH = 1,000 Btu/hr				

If no actual information is available, existing buildings constructed in or after 1978 or buildings with previously constructed additions constructed in or after 1978 may be assumed to have the values listed in Table 7-3 for insulation, fenestration U-values and solar heat gain coefficients, space-conditioning systems and water-heating systems.

Select the values from the table column that corresponds to the year that the building or previous addition was constructed.

NOTE:

Buildings with previously constructed additions may have made improvements to the older parts of the building at the time of that addition. Therefore, if the building or an addition was constructed after 1978, use the assumptions about the existing building shown for the year the addition was constructed.

Floor and fenestration areas must always be accurately calculated in both the existing and the existing-plus-addition analyses, especially for features where improvements are being made.

EXISTING-PLUS-ADDITION

The second part of the documentation is the analysis of the existing building plus the addition. It is in this part of the analysis that any energy efficiency measure improvements to the existing building (restricted as indicated in "existing building assumptions") are assumed. Other than the improvements, the remainder of the existing building is assumed to consist of the same features as were assumed for the first part of the analysis.



Compliance/
Plan Check

Existing-Plus-Addition**APPROVED COMPUTER METHODS: EXISTING-PLUS-ADDITION**

To show compliance with this approach you need to complete the following steps:

1. Collect and document information on the existing building before the remodel (see Table 7-3 for default assumptions), including:
 - Floor, ceiling, wall and fenestration areas
 - Insulation levels
 - Fenestration U-values, shading and orientations
 - HVAC equipment efficiencies
 - Water-heating systems
 - Duct leakage change (if any)
 - Other data as needed

2. Analyze the energy performance of the existing building before any changes take place using an approved computer method. Use default assumptions listed in Table 7-3 unless actual field conditions can be documented.
3. Analyze the energy performance of the existing building plus the addition, including any changes to the existing building.

When using this compliance approach it is important to take into account all changes in fenestration, especially windows and skylights which are removed from or added to the existing house as part of the remodel.

Wall, roof and floor areas also become more critical in this context, because credit may be gained by insulating previously uninsulated parts of the building envelope.

NOTE:

If the energy budget for the existing-plus-addition is greater than its energy use, then the addition complies automatically and no additional calculations are required.

4. Calculate the ratio, **F**, between the *floor area of the existing building* and the *floor area of the existing-plus-addition*:

$$F = \frac{(A_e)}{(A_{e+a})}$$

Where:

- A_e = Total conditioned floor *area* of the *existing* building, in square feet.
- A_{e+a} = Total conditioned floor *area* of the remodeled *existing-plus-addition* building, in square feet.

5. Using the energy budget/standard design and energy use/proposed design values calculated in the two computer analyses, determine whether the energy use of the existing-plus-addition is equal to or less than the adjusted energy budget for the existing-plus-addition as follows:

$$EU_{e+a} \leq EB_{e+a} + (F(EU_e - EB_e))$$

Where:

EB_{e+a} = *Energy budget, existing-plus-addition, in kBtu/yr-ft² (from the computer run on the existing-plus-addition building).*

F = *Floor area ratio (from step 3 above).*

EU_e = *Energy use, existing building, in kBtu/yr-ft².*

EB_e = *Energy budget, existing building, in kBtu/yr-ft².*

NOTE:

If $(EU_e - EB_e)$ is less than zero (0), use zero in the calculation.



Examples

Existing-Plus-Addition

Example 7-2: Existing-Plus-Addition Analysis Using an Approved Computer Method

An additional 590 ft² is being added to an existing 2,389 ft² single family house. To demonstrate energy compliance for the addition using the existing-plus-addition computer method requires the following steps:

1. Using an approved computer method, analyze the existing building before the addition. See "Existing Building Assumptions" above for more information.

The energy budget of the existing building is calculated as 45.58 kBtu/yr-ft², while the energy use of the existing building is 108.39 kBtu/yr-ft².

2. Perform a second computer analysis for the entire existing-plus-addition, including any changes to the existing building.

The energy budget of the existing-plus-addition is calculated as 42.37 kBtu/yr-ft², while the

energy use of the existing-plus-addition is 88.21 kBtu/yr-ft².

3. Calculate the floor area ratio:

$$F = 2,389 / (2,389 + 590) = 0.802$$

4. Use the floor area ratio, the calculated energy budget and the energy use values for both analyses to calculate the adjusted energy budget for the existing-plus-addition:

$$\begin{aligned} EB_{e+a} + (F)(EU_e - EB_e) \\ = 42.37 + (0.802)(108.39 - 45.58) \\ = 42.37 + (0.802)(62.81) \\ = 92.74 \text{ kBtu/yr-ft} \end{aligned}$$

5. Since the energy use of the existing-plus-addition (88.21 kBtu/yr-ft²) is less than its adjusted energy budget (92.74 kBtu/yr-ft²), the addition complies.



Construction

Existing-Plus-Addition

Make note of any construction requirements on the plans and Certificate of Compliance (CF-1R), particularly improvements to the existing building necessary to achieve compliance with the standards.

For detailed construction guidelines and documentation requirements for the builder, see Chapters 2 and 3.

As applicable, an Installation Certificate (CF-6R) for equipment and fenestration products must be completed and signed, as well as an Insulation Certificate (IC-1). Construction must be equal or better to information on the Certificate of Compliance (CF-1R).



Inspection

Existing-Plus-Addition

The inspector should make note of any improvements required to achieve compliance, as indicated on the CF-1R. The plan checker should have either verified proof of past energy efficiency improvements, or have indicated on

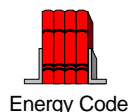
the CF-1R under “special features” any improvements that must be field verified. Proposed construction that is needed to achieve compliance will be indicated on the CF-1R.

For detailed inspection guidelines and documentation requirements, see Chapters 2 and 3.

Before making a visual inspection, check the Certificate of Compliance (CF-1R) and compare it to the Installation Certificate (CF-6R) for equipment and fenestration products, and the Insulation Certificate (IC-1) if there are any building envelope alterations.

Check for special features that require diagnostic testing - reductions in building leakage, more energy efficient duct location; and duct leakage reduction.

7.4 SPACE-CONDITIONING EQUIPMENT FOR ADDITIONS



Space Heating/Cooling

Section 152(a)

Additions to existing residential buildings shall meet the requirements of Sections 111 through 118, Section 150, . . .

EXCEPTION No. 4 to Section 152(a): *When heating and/or cooling will be extended to an addition from the existing system(s), the existing equipment need not comply with Title 24, Part 6. The heating system capacity must be adequate to meet the minimum requirements of UBC Section 310.11.*

Section 152(c)

Electric resistance water heating or space conditioning systems may be installed in or in conjunction with an addition only if the electric resistance system meets the applicable energy

budget(s) from Section 151(b) pursuant to Section 152(a)2.



Compliance/
Plan Check

Heating and Cooling Equipment

There are two options for sizing and installing heating, ventilation and air-conditioning (HVAC) equipment additions. The first is to perform design heating and cooling load calculations for the addition by itself and to install separate HVAC equipment for the addition that does not connect to the existing HVAC system.

The second option is to calculate heating and cooling loads for the existing-plus-addition and install HVAC equipment for the whole dwelling unit that meets those loads. It is acceptable to use existing heating equipment to heat the existing-plus-addition, provided the existing equipment meets or exceeds the design heating load per UBC requirements (see Chapter 2, Part 2.2).

Cooling load calculation requirements are specified in the standards when cooling equipment is installed. If you are using an existing air conditioner to cool an addition, cooling load calculations for the existing-plus-addition are recommended.

NOTE:

When existing heating and/or cooling equipment serves an addition, the existing equipment need not comply with the mandatory or compliance requirements of the standards.

Electric Resistance Space Heating

Electric resistance space heating is only allowed in an addition if a performance compliance approach (computer method) is used and the addition or existing-plus-addition complies with the applicable energy budget.

7.5 ALTERATIONS



Energy Code

Alterations, Prescriptive
(Section 152(b))

Alterations to existing residential buildings or alterations in conjunction with a change in building occupancy to a low-rise residential occupancy shall meet either 1 or 2 below [see “Alterations, Performance” for 2].

1. *Prescriptive Approach. The altered component and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110 through 118 and 150; and*

A. *Alterations that add fenestration area to a building shall be limited to a maximum 0.75 U-value for new fenestration products.*

B. *New space conditioning systems or components shall: (i) meet the requirements of Section 150(h) and (i); and (ii) be limited to natural gas, liquefied petroleum gas, or the existing fuel type unless it can be demonstrated that the source energy use of the new system is more efficient than the existing system.*

C. *New service water heating systems or components shall: (i) meet the requirements of Sections 150; and (ii) be limited to natural gas, liquefied petroleum gas, or the existing fuel type unless it can be demonstrated that the source energy use of the new system is more efficient than the existing system.*



Compliance/
Plan Check

Prescriptive Alterations

Alterations are remodels or replacements that do not result in an increase in a building's conditioned volume and conditioned floor area. Alterations include changes to the building envelope, space-conditioning system, water-heating system and lighting system. In any alteration:

- All mandatory requirements apply to the component being changed.
- Any new fenestration products must have a U-value equal to or less than 0.75.

- Equipment replacements that involve a change in fuel type are restricted, as described below.

Documentation

Compliance for a prescriptive alteration is documented on a:

1. Certificate of Compliance (CF-1R) (see Chapter 1) and
2. Mandatory Measures Checklist (MF-1R) (see Chapter 2).

MANDATORY MEASURES

Any building or equipment alteration must comply with the relevant mandatory measures contained in Sections 111 - 118, and Section 150 of the standards (see Chapter 2 for a full discussion). The unique application of mandatory measures to alterations is discussed below.

FENESTRATION REQUIREMENTS

Any added (not replaced) window, skylight, glass door or other fenestration installed as must have a rated U-value of 0.75 or less (see Chapter 2, Part 2.3 and Chapter 7, Part 7.5 on Fenestration). For the purposes of compliance for alterations, dual-glazed greenhouse windows and dual-glazed skylights may be assumed to meet this requirement (see Example 7-5).

Fenestration products that are replaced or repaired are not required to meet a maximum U-value level (see Examples 7-3 and 7-4).



Examples

Alterations—Fenestration

If I am doing an alteration, can I move an existing window to another location? Does it need to meet a 0.75 U-value?

Once you move the window to a location where a window did not previously exist, it must meet the 0.75 U-value requirement because it is added fenestration rather than a window replacement.

Example 7-3: Alteration with New Windows

An existing building has all single-pane, windows. All of the windows will be replaced, and one wall will be altered to have french doors in place of an existing window.

The 0.75 U-value requirement applies only to the window replaced with french doors. The french door must have a 0.75 or lower U-value. There is no maximum U-value for the remainder of the windows being replaced. All of the installed fenestration must meet applicable mandatory measures indicated in Chapter 2, Part 2.3.

Example 7-4: Replacing windows

An existing building has all single pane, metal frame windows. A proposed remodel will replace all the windows, no other work is being done as part of the remodel.

Since there is no added fenestration, the 0.75 U-value requirement does not apply. The installed fenestration must meet applicable mandatory measures listed in Chapter 2.

Example 7-5: Adding a greenhouse window to an existing building

An existing building has all single-pane, wood frame windows. Two double-pane metal frame greenhouse windows will be added as part of a remodel. For the purposes of alterations and additions, double-pane greenhouse windows may be treated as though they have a U-value equal to 0.75. Since greenhouse windows and some skylights add conditioned volume, but do not add conditioned floor area, this remodel is considered an alteration rather than an addition. All applicable mandatory measures must be met.



Compliance/
Plan Check

Alterations, Space Heating/Cooling

Changing space-conditioning equipment fuel types is restricted in the following way:

<u>Existing Fuel Source</u>	<u>Acceptable Replacement Equipment Fuel Source(s)</u>
---------------------------------	--

Electric	Electric, natural gas, or equipment with efficiency equal or better than existing system*
Natural gas	Natural gas, or equipment with efficiency equal or better than existing system*
LPG	Liquefied petroleum gas, natural gas, or equipment/system with efficiency equal or better than existing system*

* Proof that equipment has an efficiency that is equal to or better than the existing system can be demonstrated by an approved compliance program or other approved alternative calculation method (see Chapter 7) to compare the energy use of the existing system to the proposed system.

Changing from gas or liquefied petroleum gas to electric is not permitted with prescriptive compliance. Existing-plus-alteration compliance, explained below, is required to make such a fuel source change.

Compliance with all applicable mandatory measures is required (see below and Chapter 2).



Examples

Alterations—HVAC

If I am going to replace the heating system(s) in an existing residential building, what requirements of the standards apply? Can I change fuel types (from electric to gas)?

This scope of work will either be considered an alteration or a repair by the building department. If it is an alteration, the following mandatory requirements apply (Chapter 2):

- Certification of the equipment (not applicable to electric resistance heating equipment) (Section 111).
- Duct construction and insulation if new ducts are being installed (Section 150(m)).
- Setback thermostat requirements apply if the thermostat is replaced, unless the equipment is a gravity gas wall heater, gravity floor or room heater, noncentral electric heater, room

air-conditioners, or room air conditioner heat pump (Section 150(l)). (Existing-plus-alteration compliance is not needed for alterations).

- The building department can request sizing calculations (Section 150(h)).
- Changing fuel types is restricted as described above.

If the project is a repair, no standards requirements apply. Federal or state appliance certification requirements still apply.

Example 7-6: Alteration with New HVAC System

A new central gas furnace is to replace an existing gas furnace in a residence. New duct work will be installed, but no other changes are being made to the existing building.

The only energy requirement for this alteration is that it must meet all applicable mandatory measures for the new furnace and duct work as listed in Chapter 2.



Compliance/
Plan Check

Alterations—Water Heating

Water Heating

If a water heater is replaced in an existing building, the new water heater must meet applicable mandatory measures (see below and Chapter 2).



Examples

Alterations—Water Heating

What are the compliance requirements for replacing water heaters that are not part of an addition? What if the replacement unit is bigger? Can I change fuel types?

Replacement water heaters (which can be larger) must be certified and, if new pipes are installed, have the appropriate pipe insulation as required by Section 150(j).

Changing fuel types is restricted as described above.

If the project is a repair, no standards requirements apply. Federal or state appliance certification requirements still apply.



Energy Code

Alterations, Performance,
Alteration Alone (Section 152(b)2)

A. *The altered components shall meet the applicable requirements of Sections 110 through 118 and 150; and*

B. *Either:*

- The permitted space alone, which shall be a minimum of the square footage of the room in which the alteration is made, shall comply with Section 151; or*

EXCEPTION to 152(b)2.B.: *When the existing fuel type is electric, the existing or replacement equipment for heating, cooling and/or domestic water heating of the proposed building shall be assumed to be the same fuel type as the standard building.*



Compliance/
Plan Check

Alterations Alone, Performance

Any alteration may be analyzed alone using a computer method. This option is included for projects where it is not feasible for new fenestration products to achieve a 0.75 or lower U-value, or where a change in space-conditioning fuel type is desired. The compliance requirements are the same as showing compliance for a new building, except that the compliance is being shown for a smaller area of the building.

Refer to the program compliance supplement for further modeling information. This section discusses the application of performance compliance to an alteration. For more information on compliance with a computer method, see Chapter 5.

Documentation

Compliance for a performance alteration alone is documented on a:

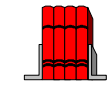
1. Certificate of Compliance (CF-1R) (Chapter 1),
2. Mandatory Measures Checklist (MF-1R) (Chapter 2), and
3. Computer Summary (C-2R) (Chapter 5).

Envelope Compliance

There is no maximum U-value requirement for window replacements with this compliance approach.

Note:

There is no special allowance for greenhouse windows and skylights with this compliance approach, as there is for prescriptive additions. See Chapter 2 for the default U-value of skylights and greenhouse windows.



Energy Code

Alterations, Performance,
Existing-Plus-Alteration
(Section 152(b)2)

- A. *The altered components shall meet the applicable requirements of Sections 110 through 118 and 150; and*
- B. *Either:*
- ...
- ii. *The energy efficiency of the existing building shall be improved so that the building meets the energy budget in Section 151 that would apply if the existing building was unchanged and the permitted space alone complied with i. The permitted space shall be a minimum of the square footage of the room in which the alteration is made.*

EXCEPTION to 152(b)2.B.: *When the existing fuel type is electric, the existing or replacement equipment for heating, cooling and/or domestic water heating of the proposed building shall be assumed to be the same fuel type as the standard building.*



Compliance/
Plan Check

Existing-Plus-Alterations, Performance

The most flexible method for showing compliance for an alteration is to consider some portion of the existing building along with the alteration. This option is included for projects where it is not feasible for fenestration products to achieve a 0.75 or lower U-value (e.g., moving existing windows from one location to a new location), or where a change in space-conditioning fuel type is desired. The compliance requirements are the same as showing compliance for an existing-plus-addition, except that the compliance may be shown for a smaller area of the building (at least the room where the alteration is occurring must be included in the compliance). By comparing building energy consumption before and after the remodel, credit may be taken for improvements to the energy efficiency features in the existing building.

Compliance is shown using an approved computer compliance program. Refer to the program compliance supplement for further information on modeling "existing-plus-addition" which has application to existing-plus-alteration. This discussion covers the application of performance compliance to an alteration. For more information on computer compliance, see Chapter 5.

Documentation

Compliance of an existing-plus-alteration is documented on a:

1. Certificate of Compliance (CF-1R) (see Chapter 1),
2. Mandatory Measures Checklist (MF-1R) (see Chapter 2), and
3. Two C-2Rs (one for the existing and one for the existing-plus-alteration for computer compliance (see also Chapter 5).

Mandatory Measures

All mandatory measures apply to any new construction. For example, if a new space-heating system is being installed in the alteration, the equipment must be certified, sizing calculations may be required, ducted

systems must meet insulation and installation requirements, and a setback thermostat is required unless the system type is shown in the exception to Section 150(i) and a non-setback thermostat is modeled. All mandatory measures are explained in Chapter 2.

Refer to the program compliance supplement for further modeling information. This section discusses the application of performance compliance to an alteration. For more information on computer compliance, see Chapter 5.

Envelope Compliance

There is no maximum U-value requirement for window replacements with this compliance approach.

Note:

There is no special allowance for greenhouse windows and skylights with this compliance approach, as there is for prescriptive additions. See Chapter 2 for the default U-value of skylights and greenhouse windows.

Existing Building Assumptions

See Part 7.3, pages 7-13 through 7-15.



Examples

Existing-Plus-Alteration

One of the performance (computer) options for showing compliance for alterations is to show that the building meets the energy budget that would apply if the permitted space complied and the remainder of the building was unchanged. Can you explain what this means and the process for showing compliance?

This process involves four steps and three separate computer runs:

1. Model the building or a part of the building before any alterations to determine the energy use (proposed design) of the existing building.

2. Model the altered space to determine the energy budget (standard design) of the alteration alone.

2. Calculate the energy budget for the *building* as:

$$\frac{(A_e \times PD_e) + (A_a \times SD_a)}{A_{e+a}} = \text{Energy Use Goal}$$

Where:

A_e = Area of the existing building before the proposed alteration (from 1.)

PD_e = Proposed design of the existing building before the proposed alteration (from 1.)

A_a = Area of the proposed alteration (from 2.)

SD_a = Standard design for the proposed alteration (from 2.)

A_{e+a} = Area of the existing building plus proposed alteration area

4. Model the building, including the proposed alteration, along with any improvements to the existing building. If the proposed design is less than or equal to the energy use goal (from 3.), the alteration complies.

For example, 250 ft² of an existing 1,500 ft² building is being altered. In step 1, computer modeling shows that the existing building uses 25.4 kBtu/ft². In step 2, the proposed alteration's energy budget is 14.2 kBtu/ft².

Calculate the energy use goal as:

$$\frac{(1,250 \times 25.4) + (250 \times 14.2)}{(1,250 + 250)} = 23.5$$

23.5 kBtu/ft² energy use goal



Construction

Alterations

Make note of any construction requirements on the plans and Certificate of Compliance (CF-1R).

For detailed construction guidelines and documentation requirements for the builder, see Chapters 2 and 3.

As applicable, an Installation Certificate (CF-6R) for equipment and fenestration products must be completed and signed, as well as an Insulation Certificate (IC-1). Construction must be equal or better to information on the Certificate of Compliance (CF-1R).



Inspection

Alterations

The inspector should make note of any improvements required to achieve compliance, as indicated on the CF-1R. The plan checker should have either verified proof of past energy efficiency improvements, or have indicated on the CF-1R under “special features” any improvements that must be field verified. Proposed construction that is needed to achieve compliance will be indicated on the CF-1R.

For detailed inspection guidelines and documentation requirements, see Chapters 2 and 3.

Before making a visual inspection, check the Certificate of Compliance (CF-1R) and compare it to the Installation Certificate (CF-6R) for equipment and fenestration products, and the Insulation Certificate (IC-1) if there are any building envelope alterations.

7.6 REPAIRS



Energy Code

Repair (Section 101(b))

REPAIR is the reconstruction or renewal of any part of an existing building for the purpose of its maintenance. Note: Repairs to low-rise residential buildings are not within the scope of these standards.



Compliance/
Plan Check

Repair

A repair to building components, systems or equipment that does not require a permit, need not comply with requirements of the standards. In some cases, the *Appliance Efficiency Regulations*, which include minimum efficiencies and certification still apply. These regulations cover:

- Refrigerators and Freezers
- Room Air Conditioners
- Central Air Conditioners
- Gas Space Heaters
- Water Heaters
- Plumbing Fittings
- Fluorescent Lamp Ballasts
- Luminaires
- Gas Cooking Appliances
- Gas Pool Heaters



Examples

Repair

The standards do not specify whether buildings damaged by natural disasters can be reconstructed to their original energy performance specifications. What requirements apply under these circumstances?

Buildings destroyed or damaged by natural disasters must comply with the energy code requirements in effect when the builder or owner applies for a permit to rebuild. The requirements that apply will depend on whether the scope of work is an addition, alteration or new building.

How can I determine if the scope of work is an addition, alteration or new building? And what requirements apply?

Section 100 of the standards indicates that the standards apply to buildings “for which an application for a building permit or renewal of an existing permit is filed (or is required by law to be filed).” It comes down to whether the change is an “addition,” “alteration,” or new building.

Changes that require a building permit for an increase in conditioned floor area and conditioned volume are “additions.” An addition meets the requirements found in Section 152(a).

Changes that require a building permit, but do not add conditioned floor area and conditioned volume, are “alterations.” An alteration is any change to an existing building's water-heating, space-conditioning or lighting system, or to the envelope that is not an addition. Alterations must meet any mandatory requirements that apply to the specific component being changed (Section 152(b)).

Rebuilding after a natural disaster (if a permit is required) will likely be either an alteration (Section 152(b)) or a new building (Section 100(d)). Requirements for new buildings apply if the local building official determines that the reconstruction is so extensive it is a new building.

Repairs and maintenance work *that do not require a building permit* are not covered by the standards.

Example 7-7: Repairing a single pane window

An existing building has all wood frame single pane windows. If one of the window panes is broken, the window may be repaired with the same type of glass as in the original. This is *not* considered an alteration, so it is *not* required to meet any requirements or to meet the alteration fenestration U-value of 0.75.